Compare predictive models created in different languages with DALEX and friends

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Why R? 2019, Warsaw, 30 September 2019

About me

- Bachelor candidate in Data Science
- Interested in:
  - XAI
  - R and Python integration
- So far ripleyed once

Faculty of Mathematics and Information Science

WARSAW UNIVERSITY OF TECHNOLOGY

MI^2 Data Lab


Hadley Wickham
@hadleywickham
Obserwuj
W odpowiedzi do @xieyihui
@xieyihui we got ripleyed too :(
09:58 - 4 gru 2012
2 polubienia
2
2
Antonio Piccolboni @piccolbo · 4 gru 2012
W odpowiedzi do @hadleywickham
@hadleywickham @xieyihui We found thorough testing and submission to CRAN to be incompatible.
Antonio Piccolboni @piccolbo · 4 gru 2012
W odpowiedzi do @hadleywickham
@hadleywickham @xieyihui I think I got Ripleyed too. A confirmed bug with a three character fix closed just because he can. No appeal.

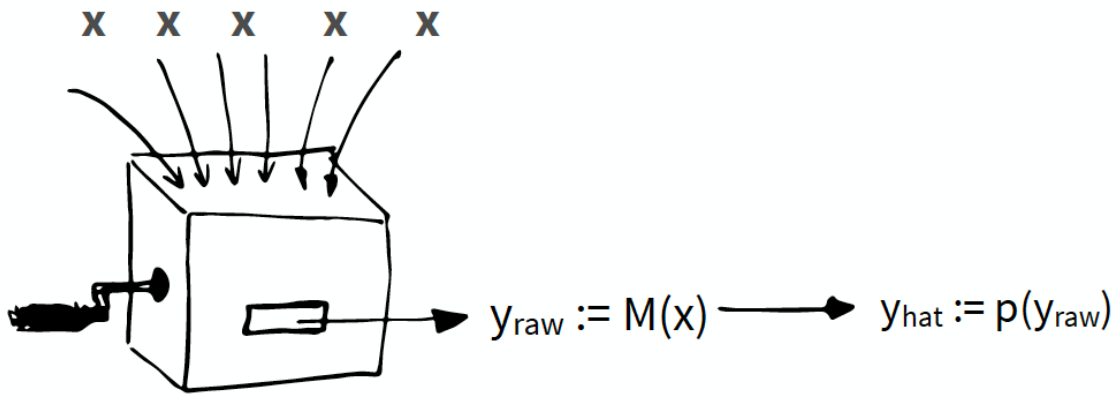
Agenda

1. Explaining Python models in R
   a) DALEX
   b) reticulate
   c) explain_scikitlearn
2. Comparison of models
   a) Common methods
   b) Funnel plot
   c) Performance audit
   d) Overall comparison
   e) Create your report!

What actually XAI is?

XAI

- Models are more and more sophisticated. They can have thousands of coefficients.
- In many applications we need to inspect how model treats our input.
- We need tools to estimate model parameters.



Why do we need to integrate?

- To establish common ground between two, significantly different, environments
  - Compare models in a unified way
  - Use same tools for every model
  - Make benchmarks that will not be affected by runtime environment

DALEX - Descriptive mAchine Learning EXplanations

- Wrapper over a model. Core of DrWhy.ai universe.
- Helps to understand how complex models are working.
- Can work with any type of black-box models.

How to integrate?

Reticulate

- Lets us evoke Python commands from R code.
- Allows to use Python object as R one.
- Trivia – will not work if user name has non-ASCII signs

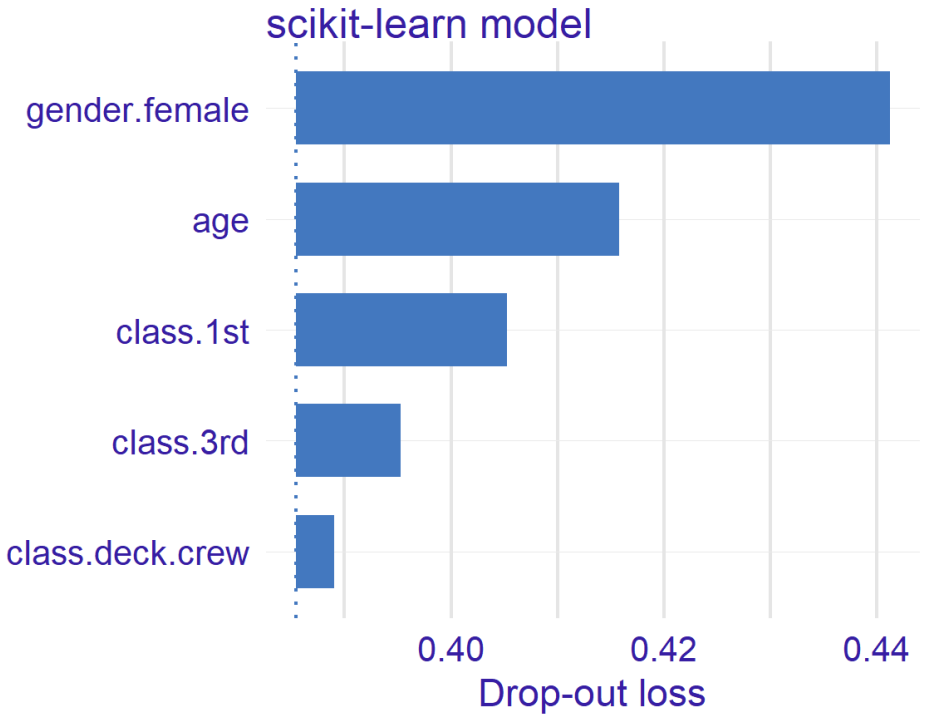
```
> library(reticulate)
> sys <- import("sys")
> sys$copyright
[1] "Copyright (c) 2001-2019 Python Software Foundation.\nAll Rights Reserved.\n\nCopyright (c) 2000 BeOpen.
com.\nAll Rights Reserved.\n\nCopyright (c) 1995-2001 Corporation for National Research Initiatives.\nAll Ri
ghts Reserved.\n\nCopyright (c) 1991-1995 Stichting Mathematisch Centrum, Amsterdam.\nAll Rights Reserved."
```

Explain!

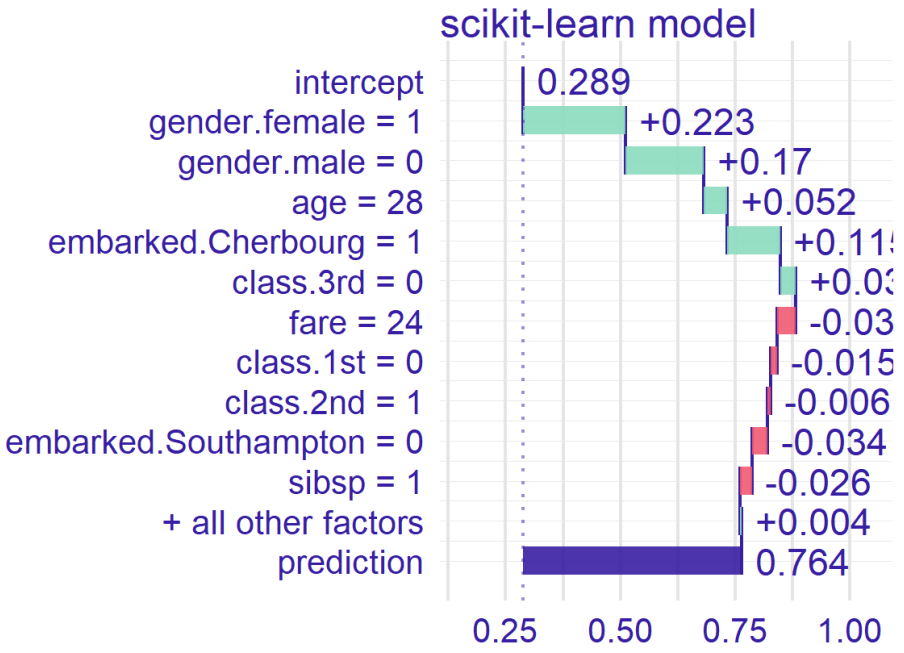
explain scikitlearn function

```
library(DALEXtra)
titanic_test <- read.csv(system.file("extdata", "titanic_test.csv", package = "DALEXtra"))
pkl_path <- system.file("extdata", "scikitlearn.pkl", package = "DALEXtra")
explainer <- explain_scikitlearn(path = pkl_path,
                                 condaenv =  "myenv",
                                 data = titanic_test[,-18],
                                 y = titanic_test[,18]
                                 )
```

ingredients



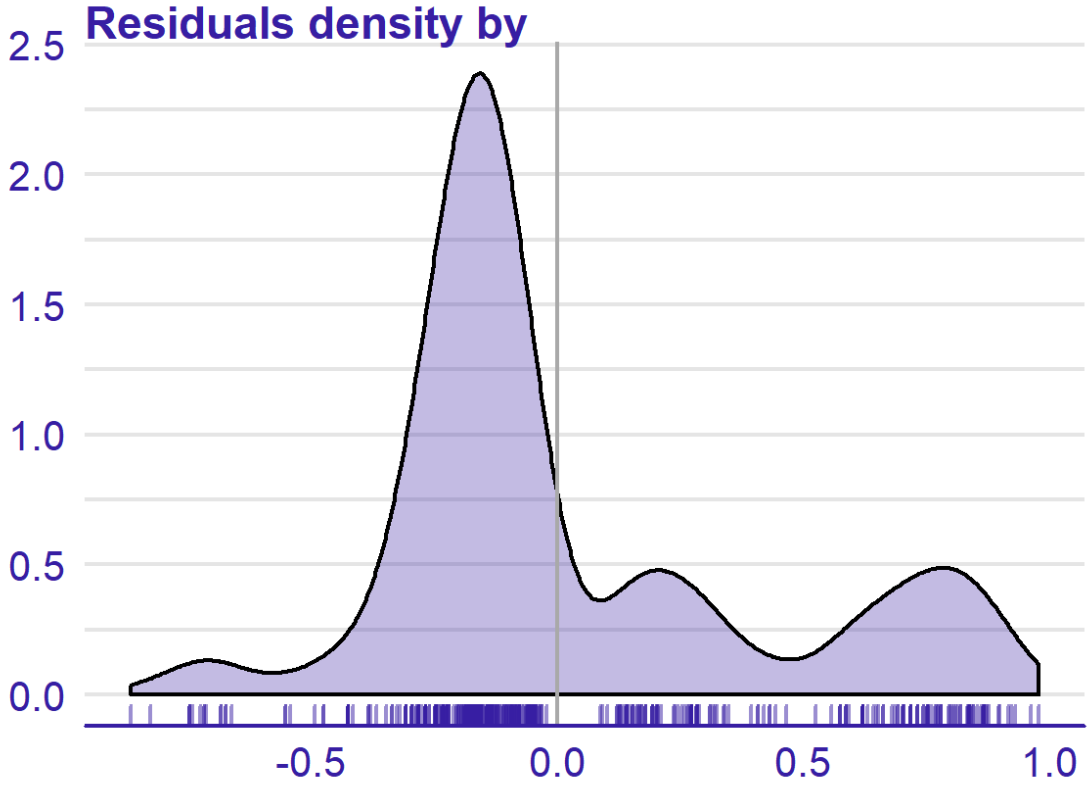
iBreakDown



explain_scikitlearn function

```
library(DALEXtra)
titanic_test <- read.csv(system.file("extdata", "titanic_test.csv", package = "DALEXtra"))
pkl_path <- system.file("extdata", "scikitlearn.pkl", package = "DALEXtra")
yml_path <- system.file("extdata", "testing_environment.yml", package = "DALEXtra")
explainer <- explain_scikitlearn(path = pkl_path,
                                 yml =  yml_path,
                                 data = titanic_test[,-18],
                                 y = titanic_test[,18]
                                 )
```

auditor package



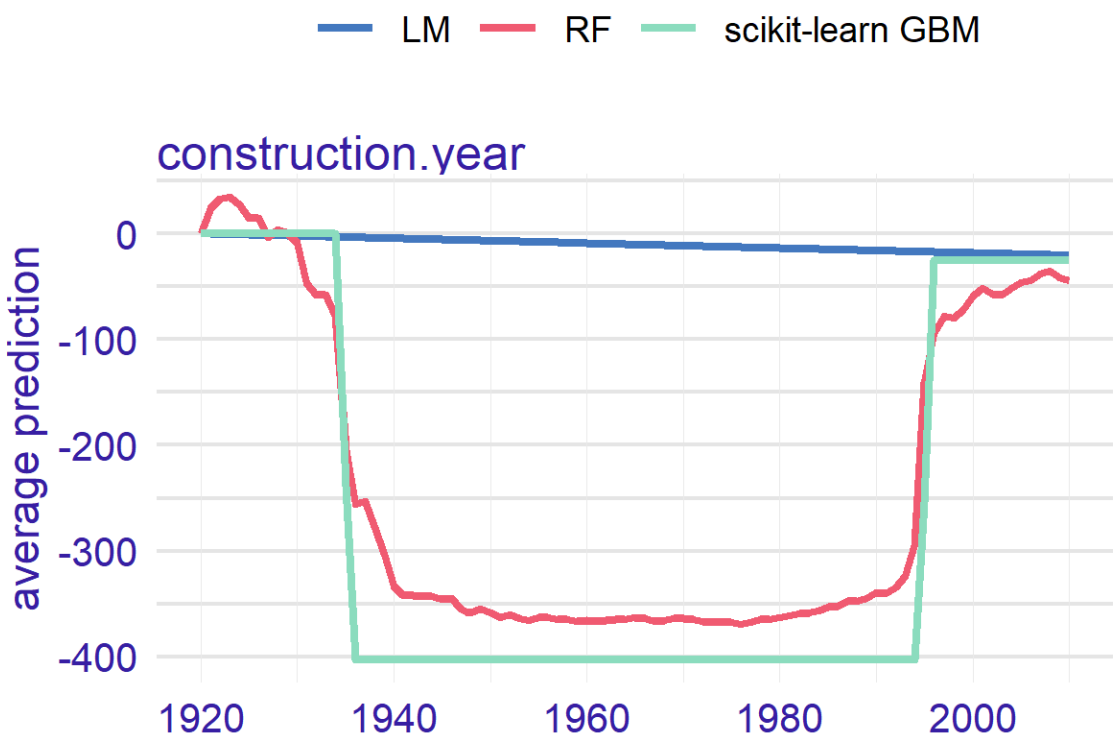

```
> explainer$param_set
criterion: friedman_mse
init: NULL
learning_rate: 0.1
loss: deviance
max_depth: 3
max_features: NULL
max_leaf_nodes: NULL
min_impurity_decrease: 0
min_impurity_split: NULL
min_samples_leaf: 1
min_samples_split: 2
min_weight_fraction_leaf: 0
n_estimators: 100
n_iter_no_change: NULL
presort: auto
random_state: NULL
subsample: 1
tol: 1e-04
validation_fraction: 0.1
verbose: 0
warm_start: FALSE
```

How can we use integration?

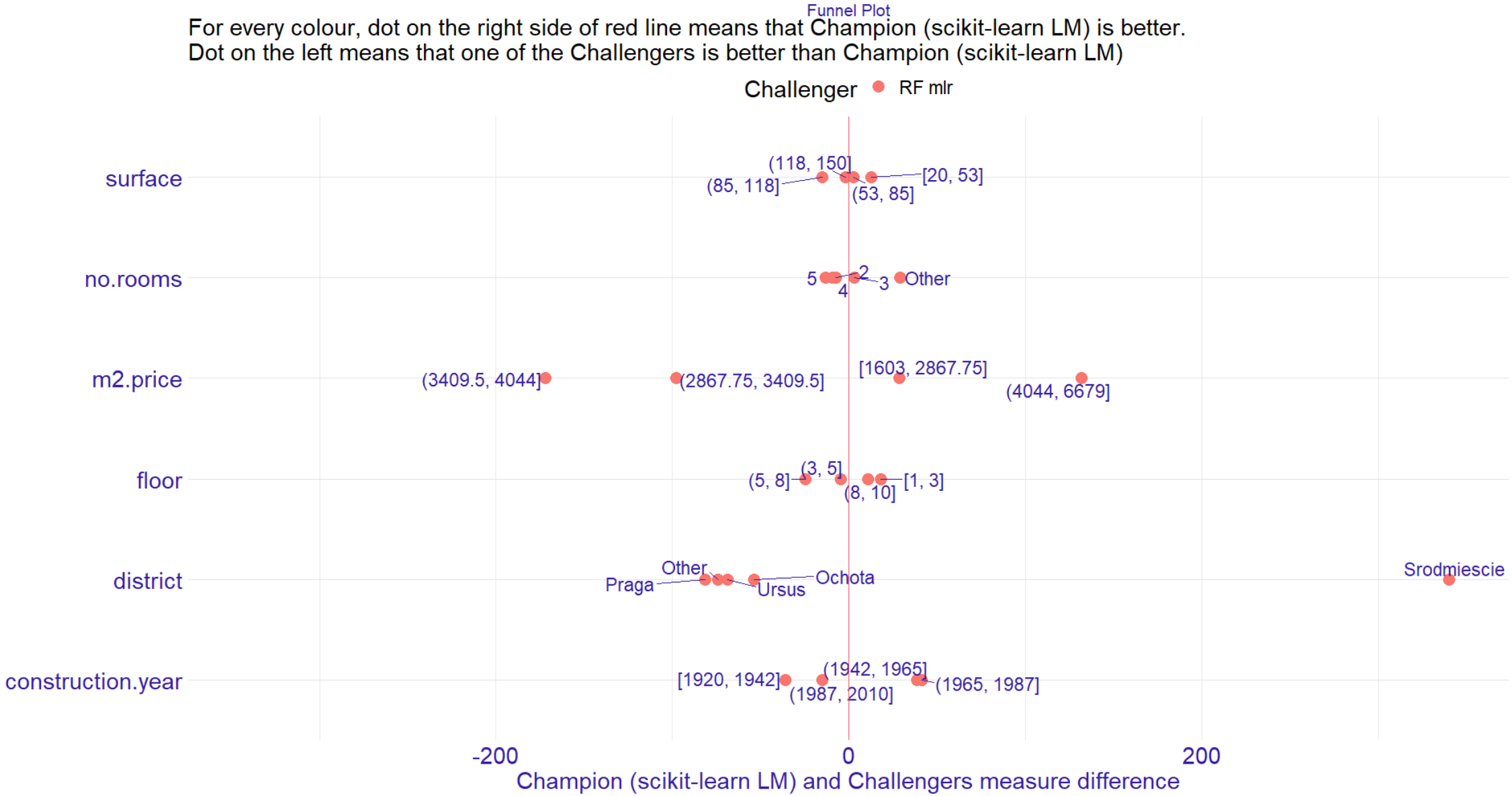
How can we compare models?

Examples of methods for model comparison

- Residual audit
  - auditor package
- Explanation comparison
  - Variable importance, variable response
- Performance
  - Comparison of measures across whole test set or its subsets



Funnel plot


Funnel Plot
For every colour, dot on the right side of red line means that Champion (scikit-learn LM) is better.
Dot on the left means that one of the Challengers is better than Champion (scikit-learn LM)
Challenger
RF mlr
surface
no.rooms
m2.price
floor
district
construction.year
(118, 150]
(85, 118]
[20, 53]
(53, 85]
5
2
4
3
Other
(3409.5, 4044]
(2867.75, 3409.5]
[1603, 2867.75]
(4044, 6679]
(5, 8]
(3, 5]
(8, 10]
[1, 3]
Other
Praga
Ursus
Ochota
Srodmiescie
[1920, 1942]
(1942, 1965]
(1987, 2010]
(1965, 1987]
-200
0
200
Champion (scikit-learn LM) and Challengers measure difference

How to use it?

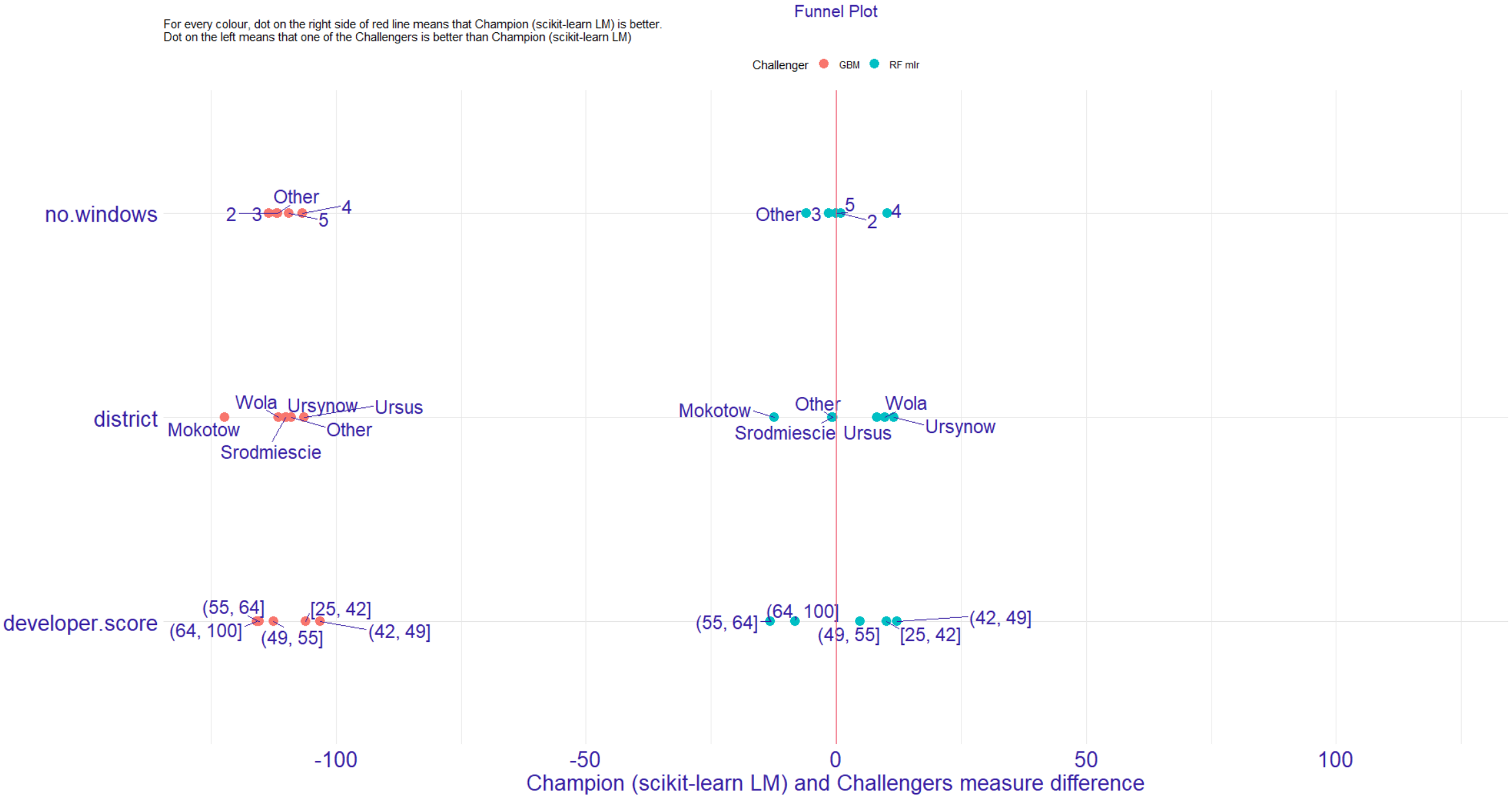
Most simple scenerio

```
plot_data <- funnel_measure(explainer_lm,
                            explainer_rf)
```

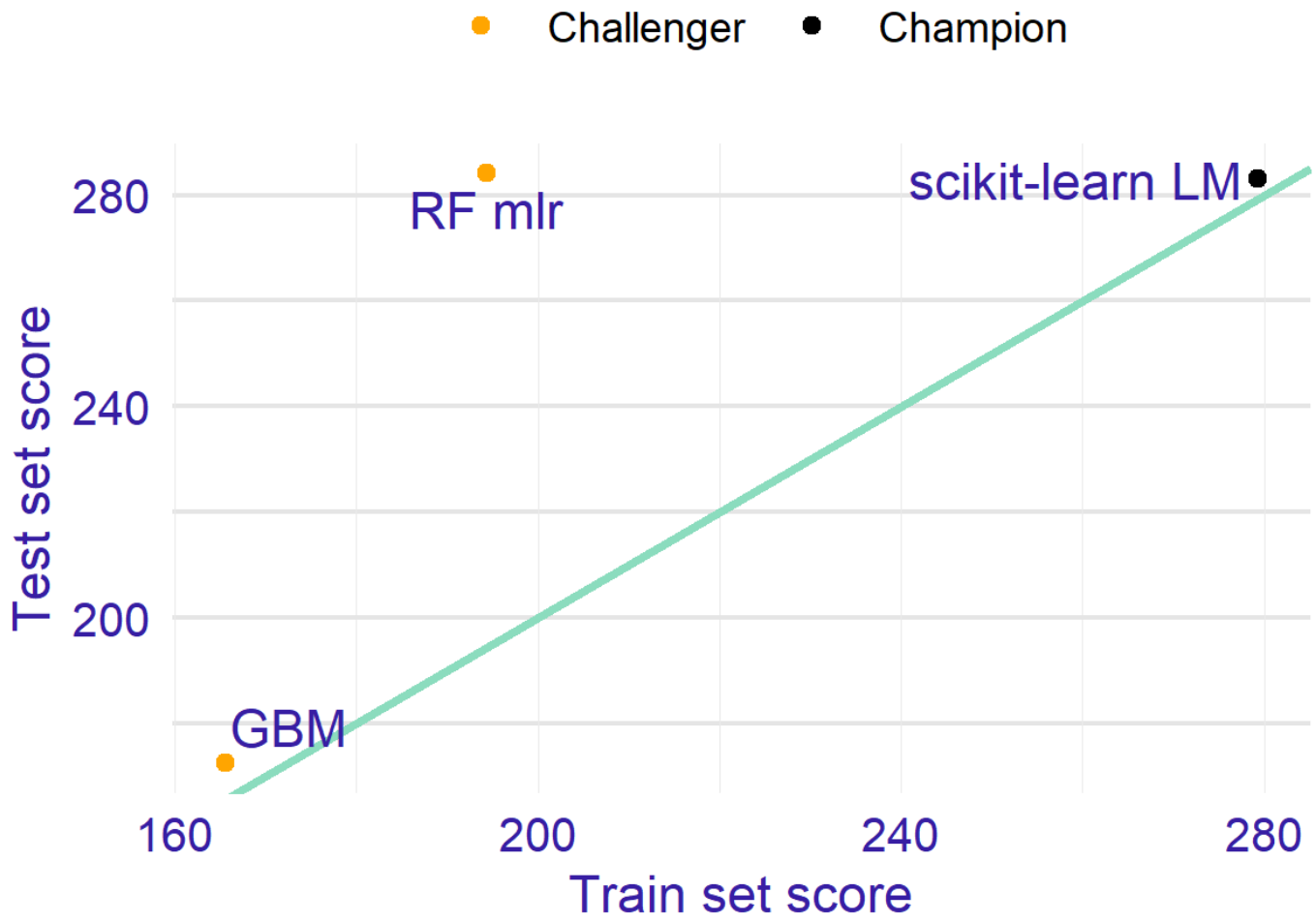
	no.windows	developer.score	district
1	2	0.8941622	Srodmiescie
2	10	0.2756634	Bielany
3	4	0.5523882	Praga
4	6	0.5332828	Ochota
5	10	0.4568613	Mokotow
6	4	0.8786960	Srodmiescie

Pro scenerio

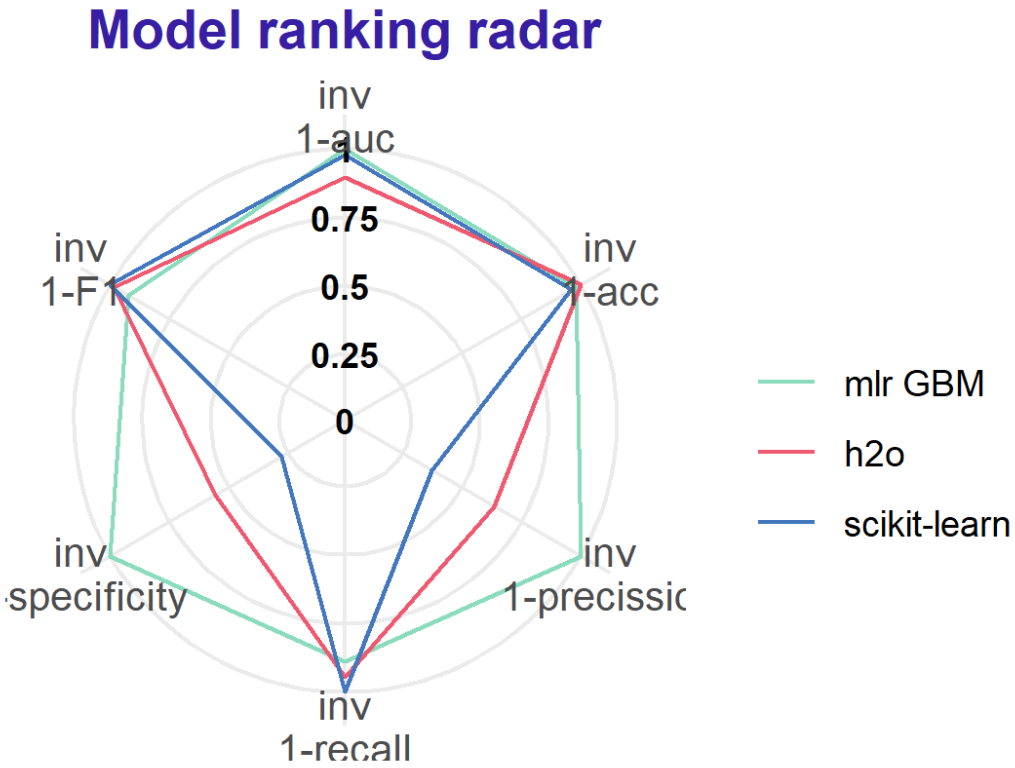
```
plot_data <- funnel_measure(champion = explainer_lm,
                            challengers = list(explainer_rf, explainer_gbm),
                            measure_function = DALEX::loss_root_mean_square,
                            nbins = 6,
                            partition_data = partition_data,
                            cutoff = 0.1,
                            cutoff_name = "Other",
                            factor_conversion_threshold = 7,
                            show_info = TRUE
                            )
```

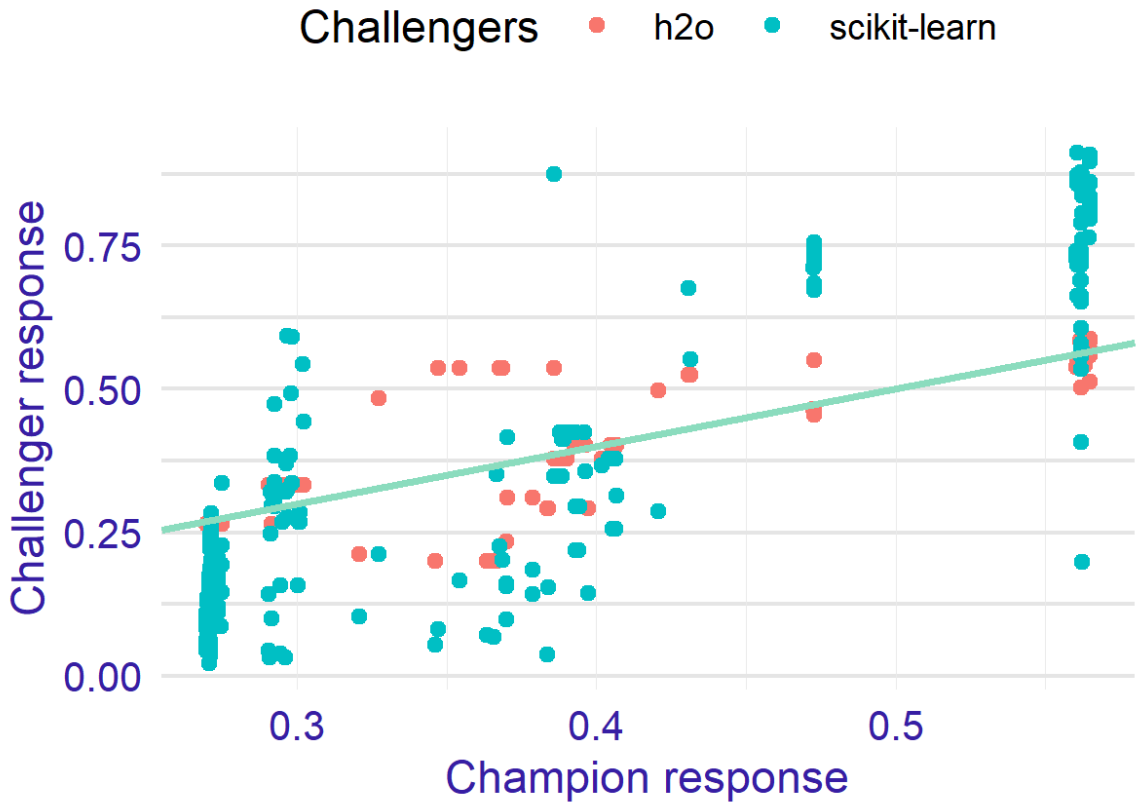

Funnel Plot
For every colour, dot on the right side of red line means that Champion (scikit-learn LM) is better.
Dot on the left means that one of the Challengers is better than Champion (scikit-learn LM)
Challenger GBM RF mlr
no.windows
district
developer.score
Other
2
3
4
5
Wola
Ursynow
Ursus
Mokotow
Srodmiescie
(55, 64]
[25, 42]
(64, 100]
(49, 55]
(42, 49]
-100
-50
0
50
100
Champion (scikit-learn LM) and Challengers measure difference

Performance audit



Overall comparison





Create report!

- Creates a report out of explanations.
- Every explanation with generic plot function can be included in the report as separate section
- Sections provided with DALEXtra have additional description in the output.

Here should be a screen of the report but I've decided to show whole instead! ☺

MI2DataLab research lab is looking for you!

Are you are intreseted in XAI, AutoML, AutoEDA other innovations in the next generation of ML?

Come to us
http://bit.do/MI2isHiring

MI

Acknowledgments

- dr hab. Przemysław Biecek, prof. PW
- dr Michał Burdukiewicz
- Alicja Gosiewska
- Mateusz Staniak
- Whole MI2DataLab team

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- https://CRAN.R-project.org/package=auditor
- https://CRAN.R-project.org/package=DALEX
- https://CRAN.R-project.org/package=iBreakDown
- https://CRAN.R-project.org/package=ingredients